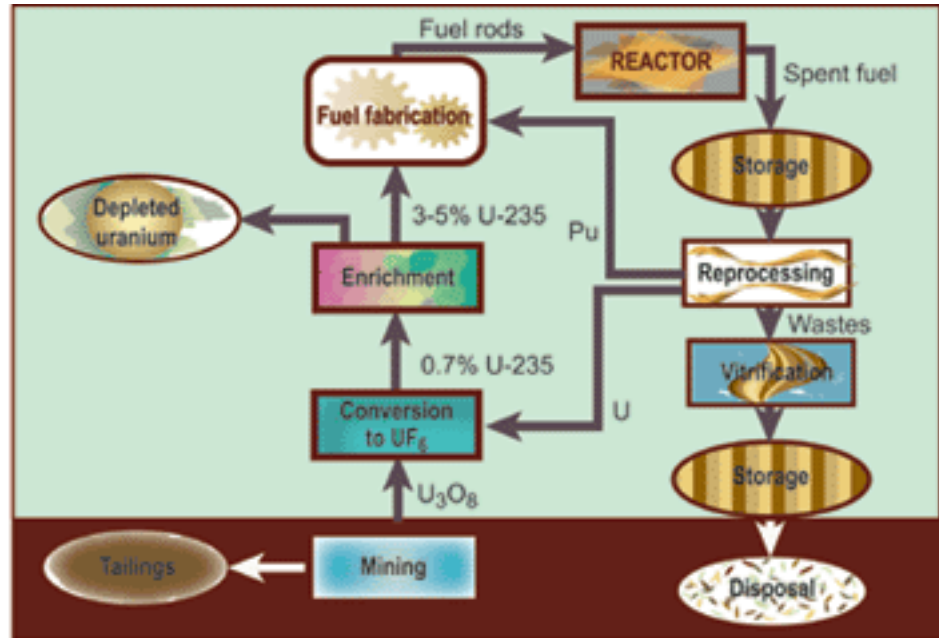


Fuel Fabrication

Most nuclear reactors use fuel made comprising of pellets of uranium dioxide encased in metal tubes, which are arranged in fuel assemblies. Uranium dioxide fuels are used in PWR, BWR and Candu reactors.



Uranium Dioxide Fuel Manufacture

In a fuel fabrication plant enriched UF₆ gas is converted to uranium dioxide (UO₂), which is formed into ceramic fuel pellets by baking it at a high temperature (over 1400°C).

The pellets are then encased in metal tubes, usually made of zirconium alloy (zircalloy) or stainless steel, to form fuel rods. The rods are then sealed and assembled in clusters to form fuel assemblies for use in the core of the nuclear reactor.

Fuel Types

Pressurized water reactor (PWR) fuel consists of cylindrical rods of Zircaloy tubes filled with UO₂ pellets put into bundles. The Zircaloy tubes are about 1 cm in diameter, and the fuel cladding gap is filled with helium gas to improve the conduction of heat from the fuel to the cladding. There are about 179-264 fuel rods per fuel bundle and about 121 to 193 fuel bundles, about 4 metres in length, are loaded into a reactor core. Control rods are inserted through the top directly into the fuel bundle.



PWR FUEL ASSEMBLY

In boiling water reactors (BWR), the fuel is similar to PWR fuel except that the bundles are "canned". That is there is a thin tube surrounding each bundle. In BWR fuel bundles, there are about 500-800 fuel rods per assembly. Each BWR fuel rod is back filled with helium to a pressure of about three atmospheres (300 kPa).

CANDU fuel bundles are about a half meter in length and 30 cm in diameter. They consist of sintered (UO_2) pellets in Zirconium tubes, welded to Zirconium end plates. Each bundle is roughly 20 kg, and a typical core loading is on the order of 4500 bundles. Current CANDU designs do not need enriched uranium to achieve criticality (due to their more efficient heavy water moderator), however, some newer concepts call for low enrichment to help reduce the size of the reactors.

Further Reading

[Uranium Enrichment](#)

[Military Warheads as a Source of Nuclear Fuel](#)

[Mixed Oxide Fuel \(MOX\)](#)

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